

REMARKS

The application has been amended and is believed to be in condition for allowance.

The case was previously pending with claims 1-20, claim 1 being independent. This amendment amends and cancels certain of the previously pending claims. This amendment also adds new claims 21-25.

The Official Action stated that a substitute specification page 5 was required.

A new substitute page 5 for the specification has been provided which clarifies the illegible character of the substitute specification page 5 provided with the Preliminary Amendment.

The Official Action rejected claims 1-20 under §112, second paragraph, as being indefinite.

These claims have been amended, or canceled, so as to remedy the stated basis of rejection. Should any of these amendments not be acceptable, it is requested that alternative acceptable language be suggested.

Reconsideration and withdrawal of the indefiniteness rejection are respectfully requested.

Claims 6-7, 16-17 and 19-20 stand rejected as either anticipated or obvious over PADOVANI 3,935,357.

Claim 8 stands rejected as either anticipated by or obvious over BARNETT 3,941,157.

Claims 9 and 18 stand rejected as anticipated or obvious over FREASE 1,677,714.

Claim 10 stands rejected as anticipated by or obvious over APTEL et al. 5,171,493 or OKAMOTO et al. 4,874,522.

Applicant notes that, apart from formal matters, claims 1-5 and 11-15 have not been rejected.

In view of the previously pending claims having been amended as to form, allowance of claim 1 and the claims depending therefrom is respectfully requested.

Applicant will below discuss the invention and rejected previously pending claims. However, applicant notes that a basis for claims 21-25 can be found in claims 1 and 8 and Examples 3, 4, and 5; in claims 1 and 7 and Examples 1 and 2; in claims 5 and 7 and Examples 1 and 2; and in claim 9 and on page 6, line 32-page 7, line 27.

The present invention is concerned with multiple channel semi-permeable membranes. The semi-permeable membranes are made by extruding a solution of a polymer in a solvent and contacting the extruded material with a coagulation agent. This agent causes the polymer to precipitate from the solvent resulting in the formation of a porous polymeric material. This porous material constitutes the wall of the multiple channel

membrane between the channels and the outer surface of the membrane and between the walls between the channels. At the surface of the extruded material, by the direct contact with the coagulation agent, smaller pores are formed, which allow the membrane to be used in separation, filtration and purification techniques, e.g., for the filtration of suspended solids or particles, or the separation of solutes and liquids, of liquids and liquids, of liquids and gases, and of gases and gases.

Multiple channel membranes can be produced by injecting air or a liquid, optionally comprising a coagulation agent, into the extruded material by means of needles provided in the nozzle of the extruder.

The inventor has found that by contacting the outer surface of the extruded membrane after leaving the nozzle first with a mild coagulation agent it is possible to fix the shape of the membrane before a fixed or solidified layer is formed. By using the method of the invention, it is possible to control the pore size on the outer surface of the membrane and the pore size on the membrane surface in the channels independently. The method also allows a better control of the outer shape of the membrane. Using the inventive method, it is possible to produce multiple channel membranes having a more complex form such as flat membranes with recessed portions between the channels or cylindrical membranes with a larger number of channels and having

only an active layer at the surface of the membrane in the channels. Advantages of such multiple channel membranes having a more complex form are discussed in the present specification, e.g., page 8, lines 2-20, page 9, lines 23-31.

In the context of the present specification, strong coagulation agent refers to a coagulation agent that causes the polymer at the surface of the extruded material to coagulate in such a manner that an active layer is formed. The active layer comprises small pores that allow the membrane to be used for separating materials. The person skilled in the art will appreciate that the pore size will depend on the nature of the polymer, solvent and coagulating agent used and concentrations thereof. As discussed in the specification, the coagulation agent may be a non-solvent for the polymer, optionally diluted with a solvent for the polymer (page 8, line 29-page 9, line 5). On the other hand, it will be understood that the desired pore size of the active layer will depend on the materials to be separated.

A mild coagulation agent refers to a coagulation agent that causes the polymer to coagulate to a degree that only relative large pores are formed such that the flow resistance of the membrane for fluids predominantly is determined by the active layer formed by contact with the strong coagulation agent.

The applicant submits that the person skilled in the art reading the specification will understand that terms mild and strong coagulation agents and on the basis of the present specification are definite. Accordingly, claim 1 is not believed to be indefinite.

Claims 6-9 and 16-19 stand anticipated or obvious in view of prior art PADOVANI, BARNETT and FREASE.

It is correct that these claims are product-by-process claims and that with this type of claims it is the patentability of the product per se that is in issue and not the patentability of the process steps employed to prepare the product.

However, applicant submits that PADOVANI, BARNETT and FREASE do not anticipate or render obvious the inventive membranes in that they do not teach or suggest the recited structures.

PADOVANI discloses hollow extruded plastic structures but the structures of PADOVANI are used for packing and are not semi-permeable membranes. PADOVANI discloses that the structures are made by using equipment such as an extruder for extruding thermoplastic materials provided with a suitable modified die head as well as devices for handling and cooling the extruded shapes thus obtained (column 2, lines 4-9). In such extruders, the thermoplastic material is melted before it is extruded through the head and cooled to solidify. PADOVANI does not

disclose extruding a solution of a polymer and contacting the extruded polymer solution with a coagulation agent to form a porous semi-permeable membrane. Therefore, PADOVANI does not disclose or suggest the inventive membranes.

BARNETT discloses hollow extruded plastic structures but the structures of BARNETT are used for conduits and are not membranes. BARNETT discloses a corrosion resistant conduit comprising a plurality of passages of a plastic material which are produced by a method wherein first a molten plastic is extruded through a die, then the hot extrudate is simultaneously cooled and sized by effecting a pressure on the interior of the extrudate. Next, the extrudate is further cooled and pulled outwardly and finally the conduit is cut into sections (column 4, lines 19-51). The walls of conduits of course should retain fluids and consequently cannot be semi-permeable. BARNETT does not disclose extruding a solution of a polymer and contacting the extruded polymer solution with a coagulation agent to form a semi-permeable membrane. Therefore, BARNETT does not disclose or suggest the inventive membranes.

FREASE relates to tubular structures for use as vacuum pipes, culverts, sheet metal columns and the like. This document having a filing date of December 29, 1924 does not disclose plastic or semi-permeable materials. In particular, it does not disclose extruding a solution of a polymer and contacting the

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extruded polymer solution with a coagulation agent to form a semi-permeable membrane. Therefore, FREASE does not disclose or suggest the inventive membranes.

In view of the above, applicant believes that the rejected claims 6-9 and 16-19 are indeed novel and non-obvious structures. Accordingly, reconsideration and allowance of these claims are requested.

An indication of allowability of all the pending claims is respectfully requested.

Please charge the fee of \$27 for the three extra dependent claims added herewith to Deposit Account No. 25-0120.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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APPENDIX:

The Appendix includes the following items:

- a substitute specification page 5
- Abstract of the Disclosure